What can Diet Quality Questionnaire food group data say about the sustainability of diets?

Anna Herforth[1,2], Tesfaye Hailu Bekele[2], Doris Wiesmann[3], Gustavo Cediel[4], Zhiyong Zou[5]

1 Harvard T.H. Chan School of Public Health, Department of Global Health and Population; 2 Wageningen University and Research; 3 independent; 4 University of Antioquia; 5 Peking University

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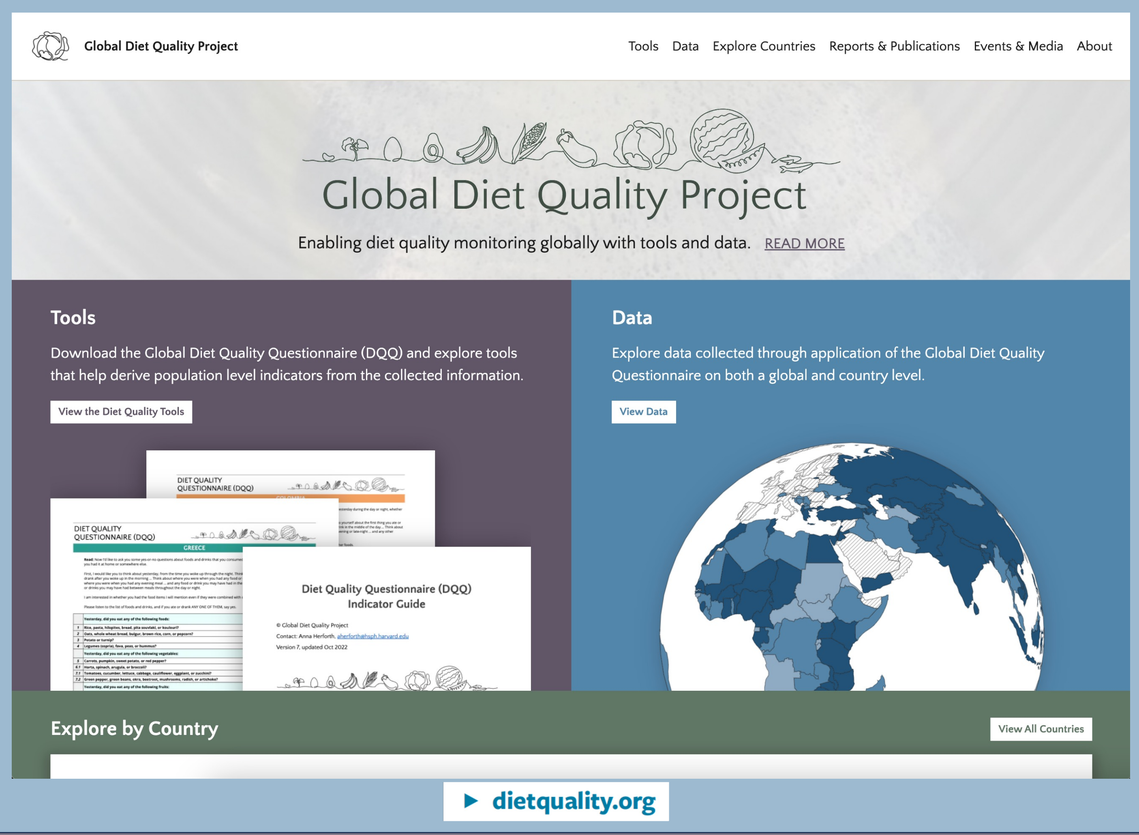
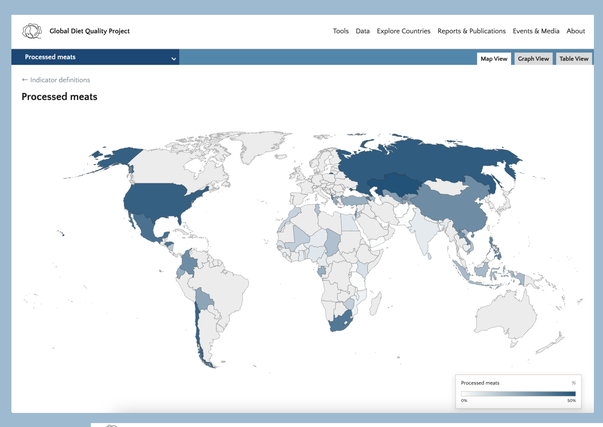
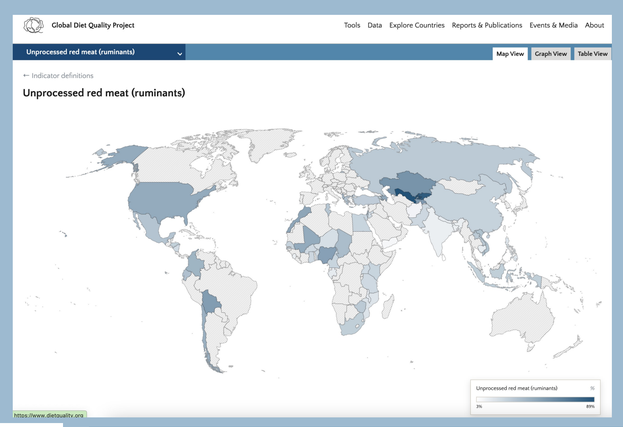
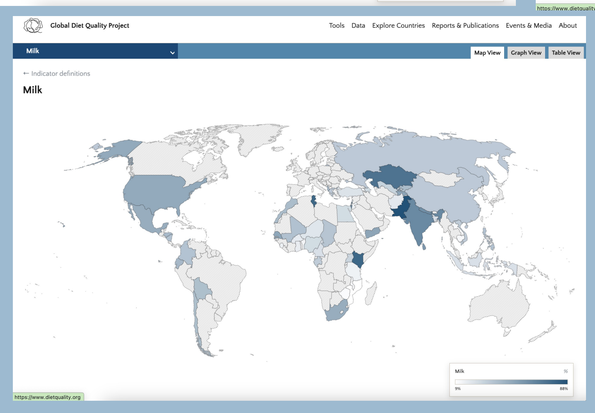
Introduction

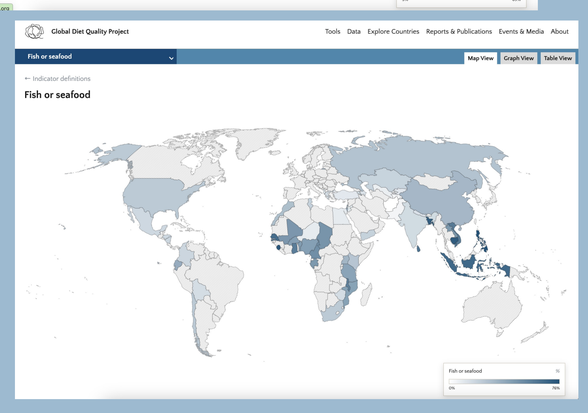
Diet Quality Questionnaire (DQQ) data are collected in >90 countries in the Gallup World Poll. The data are at food group level. What can we say about environmental impact of diets with this kind of data?









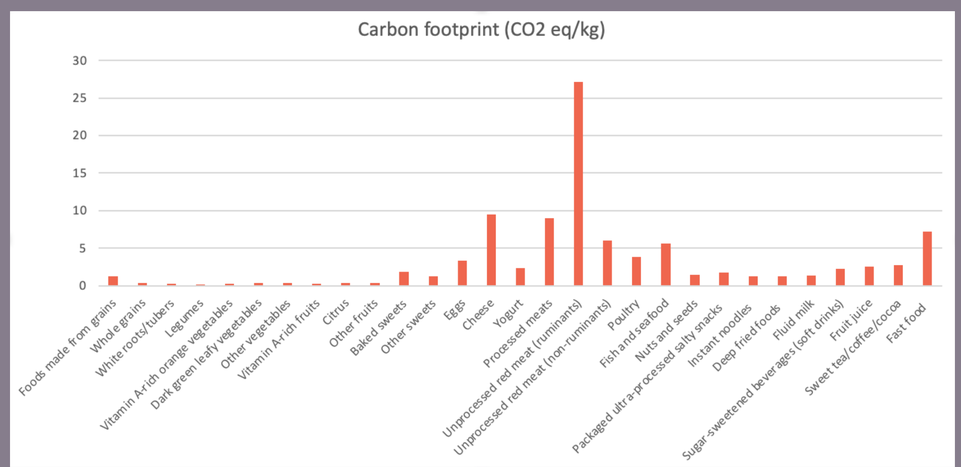


Methods

Using nationally-representative, quantitative 24-hour recall data from Bangladesh (rural), China, Colombia, and the Netherlands:

1. Assigned a carbon score based on carbon footprint of each food group: **(a)** unweighted, **(b)** adjusted for median quantity of each food group consumed, and **(c)** adjusted for semi-quantitative amount of ruminant red meat. Also counted **(d)** number of animal source foods consumed, weighted by relative carbon footprint.
2. Calculated quantitative carbon footprint of the diets.
3. Assessed the correlation between quantitative footprint and each carbon indicator.

Quantitative carbon footprint was calculated using item-specific data from Petersson et al. 2021 and Garzillo et al. 2022.



Carbon footprint of each food group, using item-specific data from FAO food balance sheets (supply utilization accounts) and Petersson et al. 2021 and Garzillo et al. 2022.

ASF score

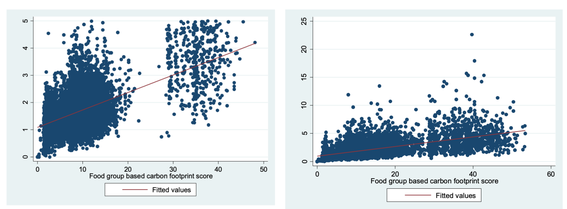
A count of the number of animal-source food groups consumed, with the following weights that reflect their average relative carbon footprint:

Milk	1
Yogurt	1
Cheese	2
Egg	1
Poultry	1
Processed meat	2
Ruminant red meat	6
Non-ruminant red meat	1

Findings

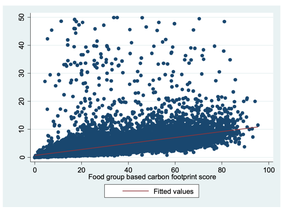
Carbon scores (unweighted)

Spearman's rho = 0.39-0.67

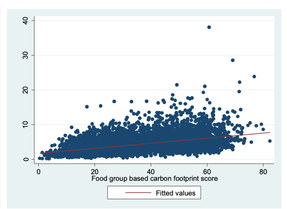


Bangladesh n=14291, r_s=0.39

China n=13139, r_s=0.61



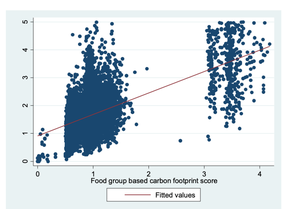
Colombia n=15742, r_s=0.67



Netherlands n=4930, r_s=0.47

Carbon scores (weighted)

Spearman's rho = 0.39-0.68



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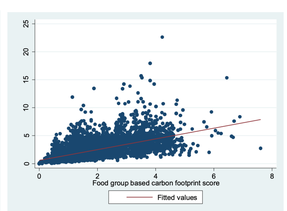
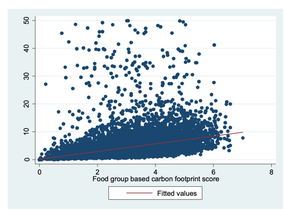
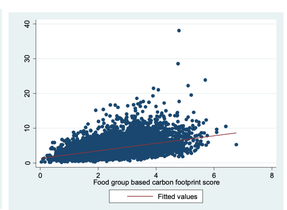


China n=13139, r_s=0.62



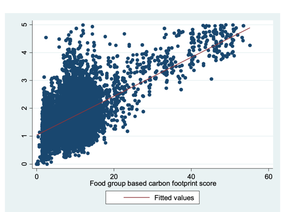
Colombia n= 15742, r_s=0.68



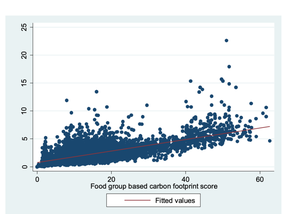
Netherlands n=4930, r_s=0.47

Carbon scores with semi-quantitative ruminant red meat measure

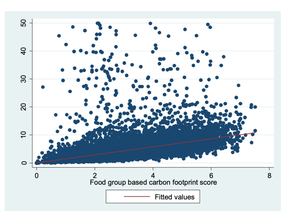
Spearman's rho = 0.39-0.75



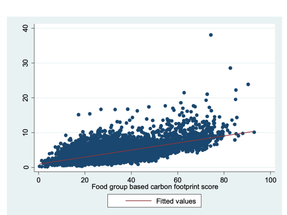
Bangladesh n=14291, r_s=0.39



China n=13139, r_s=0.61



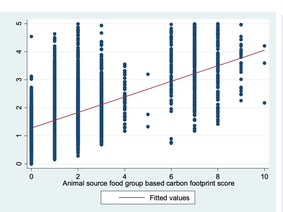
Colombia n= 15742, r_s=0.75



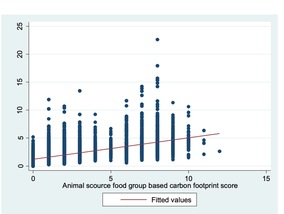
Netherlands n=4930, r_s=0.53

ASF score

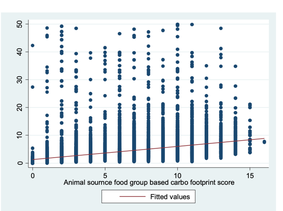
Spearman's rho = 0.37-0.63



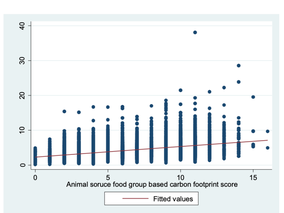
Bangladesh n=14291, r_s=0.37



China n=13139, r_s=0.58



Colombia n= 15742, r_s=0.63



Netherlands n=4930, r_s=0.42

Interpretation

Validity: All four variants of the indicators have similar correlations with quantitative carbon footprint of diets. The strength of correlation is similar to the correlation of MDD-W and micronutrient adequacy (Martin-Prével et al.). Weighting and semi-quantitative measurement of ruminant red meat do not appreciably improve the correlation. On the other hand, distilling the indicator to a carbon-weighted count of ASF consumption seems to explain the majority of the correlation. It may be preferable to use a simpler indicator of animal source foods, particularly because it has intrinsic meaning related to trophic level of diets.

Feasibility: The least data intensive metrics are the unweighted carbon score, and the ASF score: these require only food group level data. Because most countries lack recent quantitative intake data, our method of weighting by country-specific consumption is generally not scalable unless substituted with estimates from food balance sheets or models. Semi-quantitative adjustment for red meat would require asking an additional survey question. From these preliminary results, neither the food group weighting nor the semi-quantitative question improve the correlations enough to justify the increased burden and complexity.

Content: These results are for an indicator of carbon footprint / greenhouse gas emissions associated with diets. We are replicating this approach for water footprint which captures total water use. Other aspects of sustainability are important, such as land use, biodiversity loss, eutrophication potential, acidification, pesticide use, and packaging/plastic waste. These aspects, however, are quite variable by local environment and practices, and have large data gaps, particularly in the global South. We therefore did not attempt to create indicators of these, or social aspects of sustainability such as dignity, livelihoods, or animal welfare.

Conclusion

In these preliminary results, all four variants of the indicators have similar ranges of correlations with quantitative carbon footprint of diets. Simpler scores are preferable for increased feasibility. The carbon score and the ASF score show promise as proxy indicators for carbon footprint of diets at population level. Further analyses are needed and underway in five additional countries.

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